Evaluation of Selected Apicultural Practices in Combating Climate Change on Production of Honey

Orimoloye . I. FALEYIMU[1], Emmanuel Olasope, BAMIGBOYE[2]*
[1]Department of Forestry, Wildlife and Environmental Management,
Olusegun Agagu University of Science and Technology, Okitipupa, Nigeria
[2]Department of Agricultural Economics and Extension,
Olusegun Agagu University of Science and Technology, Okitipupa, Nigeria
*Corresponding author: tayo_bamigboye@yahoo.co.uk
ORCID , Faleyimu. 0000-7766-9173 ORCID: Bamigboye E.O , 0000-0002-1987-3181

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Abstract

This work was conducted to evaluate seven apicultural practices on honey production with a view to combating effect of climate change in honey production. The work was carried out at the on-station apiary demonstration (Olusegun Agagu University of Science and Technology, Agroforestry Unit) Okitipupa, Nigeria between August 2021 and March 2023. The on-station apiary layout was carried out on a primary forest within bees' friendly environment. The treatment combination consists of five different baiting materials, planting of floral along the apiary alley ways, provision of water during the dry season and provision of additional food source. The results showed average pure honey yield (phy top bar 12kg), framed hive pure honey yield (17kg,), average total revenue per hive (15 thousand Naira). The results further showed that provision of additional water source reduced the rate of absconding during the dry season, 65 percent colonization was achieved with hives treatment with foundation wax However, provision of additional honey food two months after colonization enhanced the yield of the honey and dryness of combs. Significant differences ($P < 0.05$) exist between the rate of productivity of top bar hives and framed hives. Foundation wax is therefore recommended as the best baiting material to use as it enhances faster colonization and provides food for the bees during austere floral as this will reduce the rate of bees absconding

Key words: *apicultural practices, honey production, climate change, environment.*

INTRODUCTION

Beekeeping as an agricultural practice has been identified as one of the several ways of achieving sustainable development goals (SDGs), in terms of its potential to improve the living standard in the rural Nigeria through improved food supply, and generation of productive employment. The success of beekeeping relies heavily on the possibility of establishing a suitable environment necessary for of bees to thrive for optimum production.

Not only does the practice of beekeeping have intrinsic health benefits through providing a food source of great nutritional value which is lacking in rural areas, but beekeeping requires few inputs and limited space. In rural areas, there is almost an unlimited source of pollen and bees aiding greatly in the natural cross pollination of local crops. Health benefits for rural dwellers can depend lightly on small scale agriculture to provide food and income. This could be cantered around the enriching qualities of honey in a diet which is usually dependent upon staple foods such as bananas and maize.

The importance of beekeeping in terms of social and economic benefits such as alleviation of poverty, creation of employment, improved crop yields through bee pollination and incorporation in conservation programmes cannot be underestimated. Beekeeping with its huge potentials to save the natural forests and to earn subsistence income for the rural poor is one of the agricultural sectors believed to serve as an instrument for climate change adaptation .

Since beekeeping does not require fertile land and does not compete with other resources demanding components of farming systems, it basically helps for sustainable rural livelihood. Fo

Moreover, benefit from yield of honey and beeswax is not satisfactory due to the effects of changing in the environment variables in the rural Nigeria and globally. Deficient rainfalls combined with continuing drought has been the prevailing phenomenon all over the World

In response to this, farmers have been mimicking the environment to suite the production of honey through mobilization of free labour contribution at community level focusing on soil and water conservation (SWC) to renovate the natural balance. Apart from the community labour contribution, beekeepers themselves privately started applying adaptation measures such as tree plantation, stone bund and trench implementations around the apiary (Ogunpaimo etal 2012) However, the existing environment in which beekeepers operates have not yet been systematically identified.

Honey production in the rural Nigeria, is one of the unexploited parts of the agricultural sector. This study therefore, tended to have context specific acquaintance on the most suitable environment that will be profitable for honey production in the study areas. Given the importance of honey production for environmental rehabilitation and income diversification for the rural

people, this study is aim at shedding some lights on environmental variables affecting honey production and its implication welfare of honey producers.

Beekeeping is emerging as a very successful agricultural practice for local people in rural areas of less develop countries. Not only does the practice of beekeeping have intrinsic health benefits through providing a food source of great nutritional values which is lacking in rural areas, but beekeeping requires few inputs and capitals and ready supply of pollen. In rural areas, there is almost an unlimited source of pollen and bees aid greatly in the natural cross pollination of local crops. Health benefits for local people reliant on small agriculture to provide food as centered around the enriching qualities of honey in a diet which is usually dependent upon staple foods such as bananas and maize.

The Importance of beekeeping in terms of social and economic benefits such as alleviation of poverty, creation of employment, improve crop yield through bee pollination and incorporation in conservation programmes cannot be underestimated. Bee keeping with its huge potentials to save the natural forest and to earn subsistence income for the rural poor is one of the agricultural sectors believed to save as an instrument for climate change adaptation .

All over the world, beekeeping is an integral part of agriculture. Bees are of inestimable value as agents of pollination and many plants are entirely dependent on them. To buttress this, Lietaer (2010) stated that many ecosystems depend on the pollination of bees for their existence and for increasing their genetic diversity (cross-pollination). An estimated eighty percent of flowering plants are entomophilous i.e. depending more or less on insect pollination to be able to reproduce, and it is estimated that half of the pollinators of tropical plants are bees (Bradbear, 2011). Farmers benefit from bee pollinated roles in the ecosystem as bee pollinate 70% crop species (Klein et al., 2007) that feed 90% of the world population.

Since beekeeping does not require fertile land and does not compete with other resource demanding component of farming systems, it basically helps for sustainable rural livelihood. For example, South west ,Nigeria has a long history in beekeeping practices through which enormous farmers have still generated their means of livelihoods. Despite the long history in beekeeping and its endowment with favourable natural resources for the honey production, its honey contribution to the beekeepers' livelihood is very low the resultant effect may be attributed to climate change.

One of the most fundamental challenges facing Nigeria today is how to ensure that all her citizenry have enough food for a healthy and productive life and this has been largely hampered by erratic climatic condition. Nigeria is feeling numerous effects of climate change with evidence of increased temperature and severe drought with enormous stress on water availability for flora development which is basically the food of bees (Antwi- Agyen and Stringer, 2021)

This affects planting and harvesting dates of crops, absconding of bees, empty combs, dried combs, pure honey becoming crystallized which eventually lead to low production both in quantity and quality, hence, low income which drives households' welfare. There is therefore an urgent need to evaluate good apiculture practices in combating the effects of climate change on honey production Bamigboye (2015) investigated the climate change adaptation strategies used among arable crop farmers in South west, Nigeria but no work has been done to evaluate the the effects of apicultural practices in combating the effect of climate change in honey production .

The objective of this work was to evaluate selected apicultural practices in combating climate change in honey production in Olusegun Agagu University of Science and Technology (OUASTECH), Okitipupa, Nigeria , the study also **e**stablish ON-Station apiary demonstration at (OUASTECH), Okitipupa, facilitate planting of drought resistant and multi-purpose bee plant species to improve bee forage around apiaries e.g *Tectonia diversifolis*, *M*oringa *nolifera*, examine the efficacy of seven different baiting materials on the colonization of beehives, examine the best hive design that attracts bees fast (Kenya top bar and framed hives)..determine the rate of absconding in the study site and determine the yield potentials and profitablity of honey in on station demonstration of the two types of hives

MATERIALS AND METHODS

Experimental Sites

The work was carried out at the on-station apiary demonstration (Olusegun Agagu University of Science and Technology, Agroforestry Unit) Okitipupa, . The on-station apiary layout was carried out on a primary forest within bees' friendly environment on longitude 6 . The onstation experiment was carried out between Oct 2021 and March 2023 to allow for two seasons of honey production.

The following plants were found within the experimental : Eupatorium odoratum, Tectona grandis, Irvingia gabonensis, Anana comosus

Citrus species, Mangifera indica, Manihot species, pit yrograma calomelanos

Elaeis guinensis, Moringa Olifera, Anacadium occidentale, gmelina arborea which are good nectar source are found in the site.

Experimental Materials

The experimental materials consists of Kenyan top bar hives framed hives 10 each and a total of 20 hives were used. for the experiment and were made from Omo tree

(Terminalia ivorensis). (Adjare, 1984 and Akanbi 2002).

Experimental Design

Experimental Factors Levels Arrangement ON-STATION

Table 1

Main Factors

	Main Plots	Sub-plots	
	1. Framed hive	2. Top bar hive	3. Practices
Factor Levels	a. Foundation wax b. FermenteLocust beans c. Honey lotion	a. Pure honey b. Perfume c. Slurry	a. H_2O bows b. Multiple floral c. Additional feeds

Table 2

Treatment Combination	Treatment Description
1a x 2a x 3a	Foundation wax x pure honey x H_2O bars
1a x 2b x 3a	Foundation wax x perfume x H_2O bars
1a x 2a x 3b	Foundation wax x pure honey x multiple floral
1a x 2b x 3b	Foundation wax x perfume x multiple floral
1a x 2c x 3b	Foundation wax x slurry x multiple floral
1a x 2b x 3c	Foundation wax x perfume x additional feeds
1a x 2c x 3c	Foundation wax x slurry x additional feeds
1b x 2a x 3a	LB x pure honey x H_2O bars

1b x 2b x 3a	LB x perfume x H_2O bars
1b x 2a x 3b	LB x pure honey x multiple floral
1b x 2b x 3b	LB x perfume x multiple floral
1b x 2c x 3b	LB x slurry x multiple floral
1b x 2b x 3c	LB x perfume x additional feeds
1b x 2c x 3c	LB x slurry x additional feeds
1c x 2a x 3a	Lotion x pure honey x H_2O bars
1c x 2b x 3a	Lotion x perfume x H_2O bars
1c x 2a x 3b	Lotion x pure honey x multiple floral
1c x 2b x 3b	Lotion x perfume x multiple floral
1c x 2c x 3b	Lotion x slurry x multiple floral
1c x 2b x 3c	Lotion x perfume x additional feeds
1c x 2c x 3c	Lotion x slurry x additional feeds

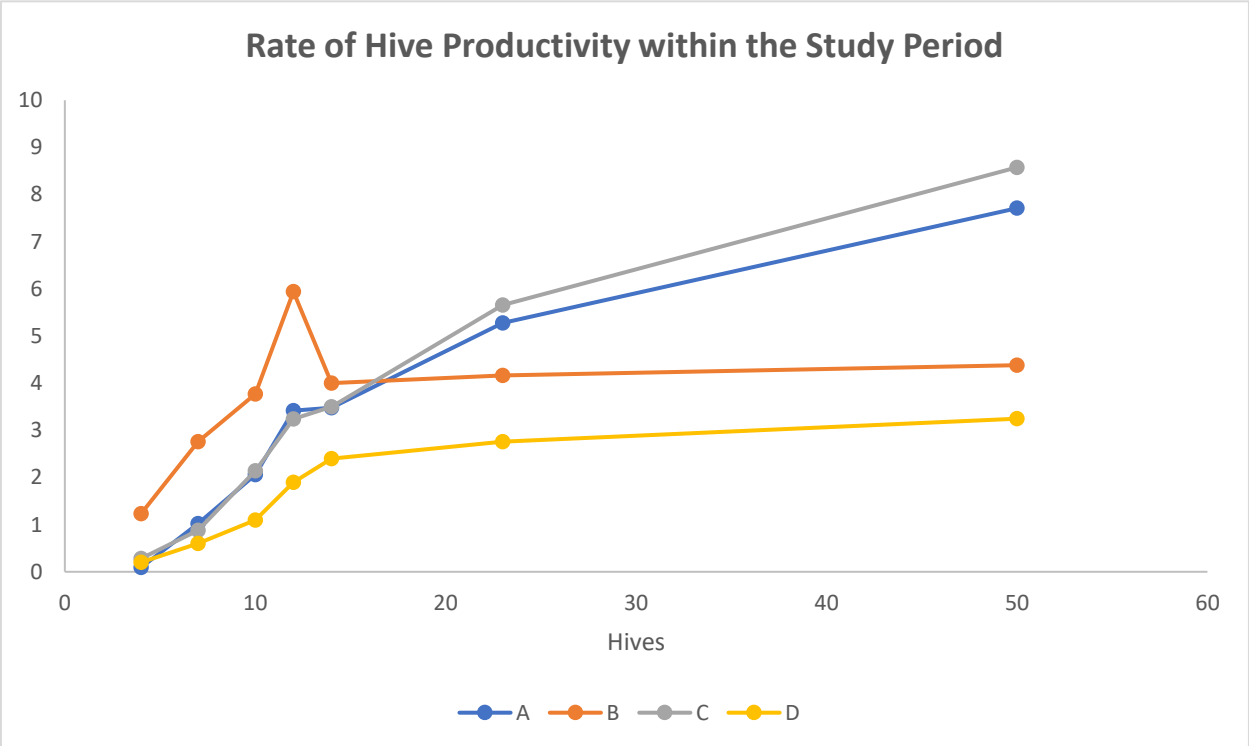
RESULTS AND DISCUSSION

The following are the results obtained from the research work. It includes the production efficiency of each hive with respect to the colonization, absconding, rate of comb formation , honey yield all measured in kilograms and determination of apicultural practices that helps in combating climate change

Rate of Hive Productivity within the Study Period

It denotes the growth of the comb recorded at the onset of baiting, and subsequently every two weeks. The table shows the weekly result of the comb development in each hive listed, of which A represents the top bar hives , B represents the framed hives which were replicated 3times . For the two weeks after baiting, no comb was formed in any of the hives , by extension none of the hives had been colonized . By the fourth week 5 framed hives had been colonized, but at varying degrees of activeness. Whereas only one top bar hive was colonised, For the period of the study framed hives shows good performance.

Hive	A	B	C	D
1				
2				
3				
4	0.09	1.23	0.28	0.20
7	1.02	2.76	0.88	0.60
10	2.06	3.77	2.14	1.10
12	3.42	5.94	3.24	1.90
14	3.48	4	3.5	2.40
23	5.28	4.162	5.66	2.76
50	7.71	4.3807	8.576	3.246

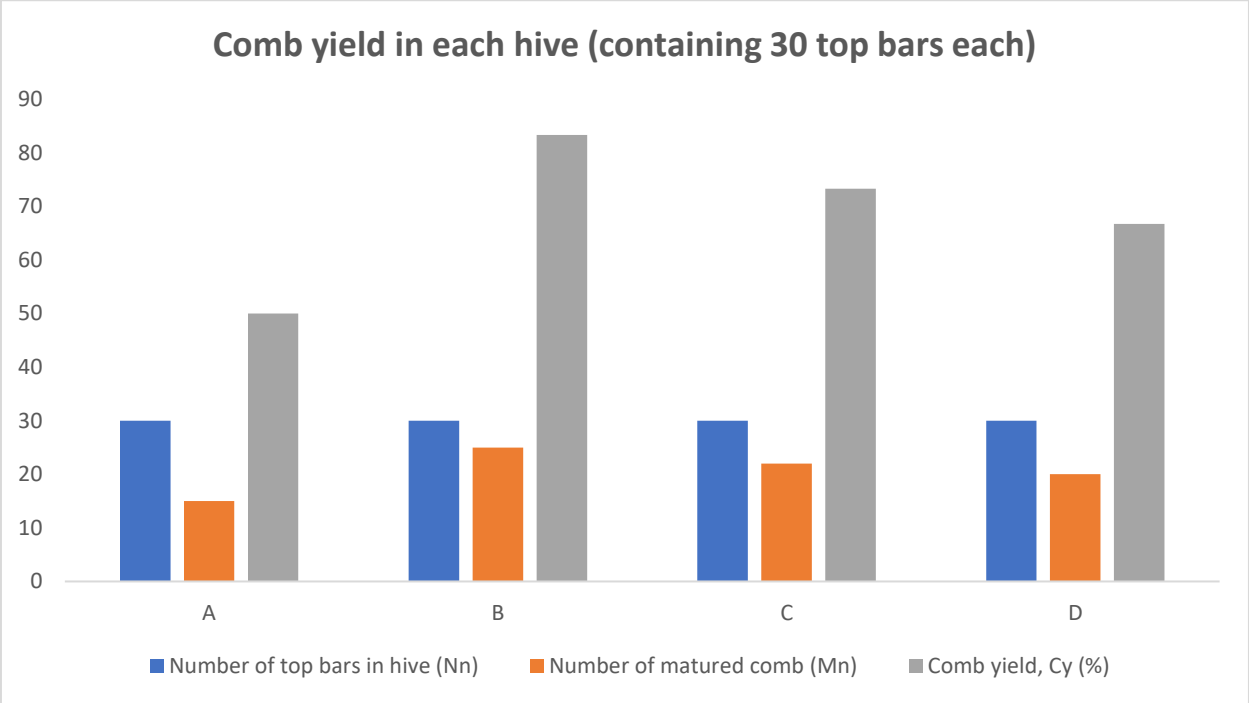


	A	B	C	D
Number of top bars in hive (Nn)	30	30	30	30

Comb Yield in each Hive

Here, a comparison is made between the number of top bars in each hive, and the number of matured combs finally gotten during harvest as shown in the table. The number of top bars in each hive is the same. But due to the reason stated above in 4.1, the number of matured combs has been calculated by dividing the number of matured combs harvested from each hive by the number of top bars, while the bait efficiency was calculated by dividing the weight of the residue amassed after processing by the weight of the pure honey extracted.

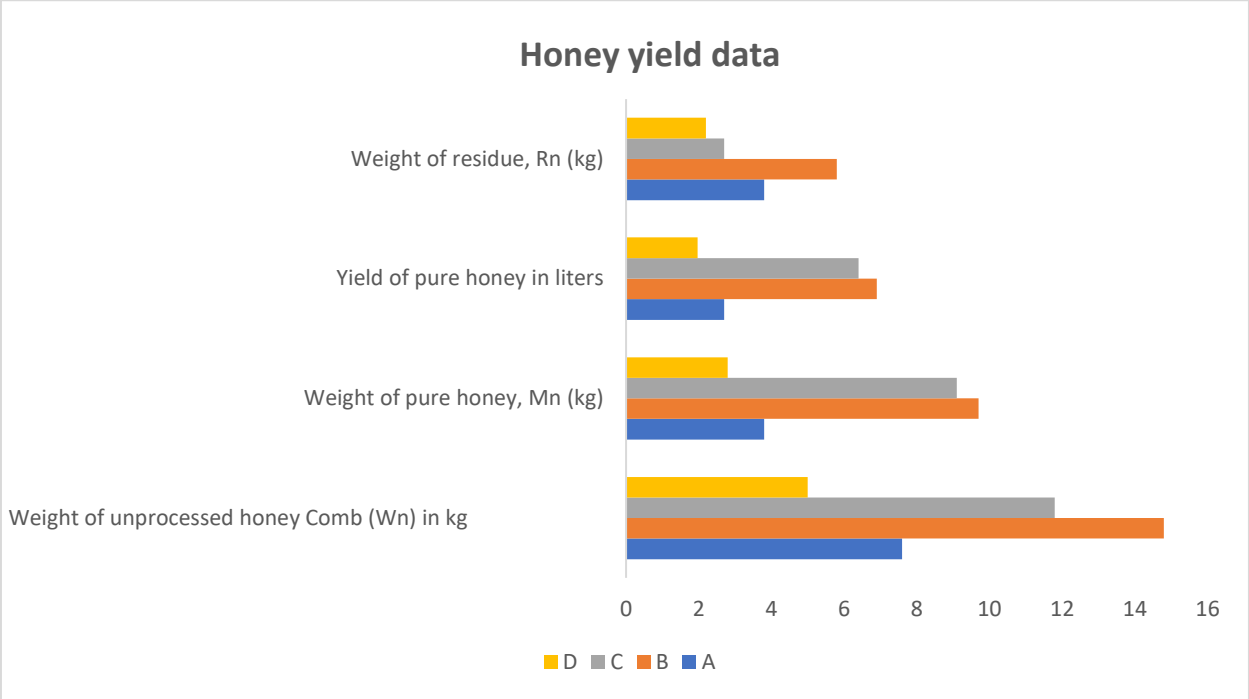
	A	B	C	D
Number of matured comb (Mn)	15	25	22	20
Comb yield, Cy (%)	50	83.3	73.3	66.7



Hive	A	B	C	D
Weight of unprocessed honey Comb (Wn) in kg	7.6	14.8	11.8	5.0
Weight of pure honey, Mn (kg)	3.8	9.7	9.1	2.8
Yield of pure honey in liters	2.7	6.9	6.4	1.97
Weight of residue, Rn (kg)	3.8	5.8	2.7	2.2

Honey Yield Data

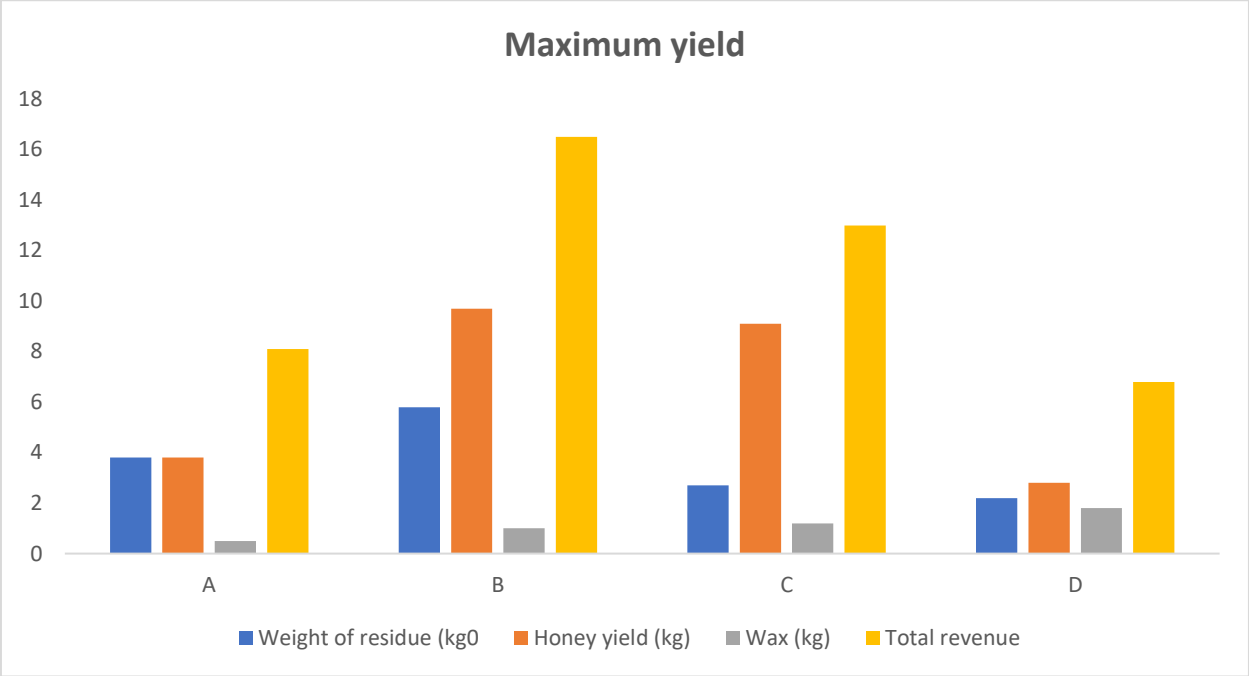
The hives are represented in this table with respect to the weight of all the proceeds from the processed harvest. The recorded data in the table below indicates the final results from each hive. As usual, the hive in the primary forest honey yield 9.3kg is the most productive, while the hive at uphill location yield 2.8kg is less productive, the hive in the secondary forest and oil palm plantation were averagely productive.



Hive Type	A	B	C	D
Weight of residue (kg0	3.8	5.8	2.7	2.2
Honey yield (kg)	3.8	9.7	9.1	2.8
Wax (kg)	0.5	1.0	1.2	1.8
Total revenue	8.1	16.5	13.0	6.8

Maximum Yield

The total yield or the maximum yield is the sum of all the proceeds from the hives. It adds up the weight of the residue and honey yield -which is also the weight of pure honey to give the correct value of the total yield. Table 4.4 gives a comprehensive data of the maximum yield discovered in each of the four beehives.



The result in figure 1 of the apiculture practices profile indicated that two of the practices were significant in control of climate change in honey production. High incidence of this practices and colonization justifies their potency. Early colonization and high honey yield observed in foundation wax and additional water supply made it also recommendable to farmers as baiting material and good apiculture practice in combating climate change in honey production

Figure1: Effect of baiting materials on apiculture practices parameter in combating climate change .

Parameters	Incidence of colonization and yield						
	I	II	III	IV	V	VI	S.E
Additional feeds	15.91^{b}	15.79^{b}	16.58^{a}	15.14^{c}	15.94^{b}	15.84^{c}	0.0697
Planting drought res	5.47	5.98	5.33	5.33	5.47	5.48	0.0462
Bee shelter	11.77^{bc}	12.61^{a}	12.15^{b}	11.46^{cd}	11.15^{d}	11.47^{d}	0.1495
Using of different hives	38.53	37.06	37.04	37.01	38.53	38.87	0.5138
Additional water	35.35	34.15	36.03	35.08	34.93	35.25	0.3122
Using of scent tree	35.90^{b}	35.05^{c}	36.13^{b}	34.98^{c}	36.60^{a}	36.70^{a}	0.0506

Means followed by the same letter along the column are not significantly different using Tukeys' HSD at 5% probability level

Conclusions and Recommendation

All the seven evaluated apicultural practices shows the potential for combating climate change in the study area but provision of additional food source during dry season when there is paucity of floral was ranked best in controlling absconding and provision of water source at the apiary premises helps in reducing rate of comb dryness and crystallization which is one of the problem of ensuring pure honey under austere weather condition. Foundation wax is therefore recommended as the best baiting material to use as it enhances faster colonization and additional source of water must be provided within the apiary as this will reduce the rate of bees absconding and dryness of comb Also primary forest is the most suitable environment for beekeeping and honey production since bees are attracted quickly

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